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<p>(21) International Application Number: PCT/US00/12224 (22) International Filing Date: 5 May 2000 (05.05.00) (30) Priority Data: 60/132,822 6 May 1999 (06.05.99) US (71) Applicant: QUALCOMM INCORPORATED [US/US]; 5775 Morehouse Drive, San Diego, CA 92121-1714 (US). (72) Inventors: CLAXTON, Daniel, D.; 16575 Zumaque Street, Rancho Santa Fe, CA 92067 (US). KERR, Richard, J.; 4755 Thurston Place, San Diego, CA 92129 (US). (74) Agents: MINHAS, Sandip, S. et al.; Qualcomm Incorporated, 5775 Morehouse Drive, San Diego, CA 92121-1714 (US).</p>		<p>(81) Designated States: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, DE, DK, DM, DZ, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p><b>Published</b> <i>With international search report. Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i></p>
<p>(54) Title: TWO-PIN CONNECTION FOR PORTABLE PHONE KEYPAD</p>		
<p>(57) Abstract</p> <p>A keypad on a flip cover is electrically connected to the electronics located within the body of the communications device using a two-pin connection. The flip cover contains a first set of electrical contacts and the body of the communication device contains a second set of electrical contacts. When the flip cover is closed, the electrical contacts on the flip cover make contact with the electrical contacts on the body of the communications device to form an electrical connection that enables signals from the keypad to be sent to a microprocessor in the body of the communications device for processing.</p>		

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## TWO-PIN CONNECTION FOR PORTABLE PHONE KEYPAD

### BACKGROUND OF THE INVENTION

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#### I. Field of the Invention

The present invention relates generally to the field of mobile communications. More particularly, the present invention relates to a system and method for connecting a keypad on a flip cover to the electronics located within the body of a communications device using a two-pin connection.

#### II. Background

Many mobile communications devices are now combining wireless phone technology with hand-held computer platforms that provide personal information management. Such hand-held computer devices are called personal digital assistants (PDAs). Combination mobile communications devices usually operate as two separate instruments, requiring separate liquid crystal displays (LCDs) and additional circuitry to read the separate input devices of the wireless phone and the PDA.

Matrix encoded keyboards and keypads are used extensively as input devices for computers and telephones. Such keyboards and keypads are usually mounted on a flex circuit and require multiple signals to detect which key is pressed. For example, a 4 by 4 matrix keypad, which contains sixteen input keys, requires eight signals. When the keyboard or keypad is implemented on a flip cover, as may be the case with a wireless phone or PDA, multiple signals are routed to the body of the communications device through a hinge. The routing of multiple signals through a hinge causes the instrument to be less durable and may lead to the breakage of the hinge if the instrument is constantly picked up by grasping the flip cover.

Many PDAs require a two-channel analog-to-digital converter (ADC) to read the touch panel. When the PDA is combined with a wireless telephone that implements the keypad on a flip cover, additional circuitry usually includes an additional ADC to read the keypad on the flip cover and an additional LCD for the wireless telephone display.

What is needed is an efficient and cost effective way to integrate a PDA and wireless telephone with a flip cover that is lightweight, durable, and easy to operate. What is further needed is the integration of a PDA and wireless telephone that provides user input from a keypad on the flip cover without using a cable to connect the signals from the keypad to the electronics located in the body of the PDA and wireless telephone.

### SUMMARY OF THE INVENTION

The present invention satisfies the above mentioned needs by providing a communications device that efficiently integrates a flip telephone with a personal digital assistant (PDA). The present invention operates as a single unit. According to the present invention, a keypad on a flip cover is electrically connected to the electronics located within the body of the communications device using a two-pin connection. The flip cover contains a first set of electrical contacts and the body of the communications device contains a second set of electrical contacts. When the flip cover is closed, the electrical contacts on the flip cover make contact with the electrical contacts on the body of the communications device to form an electrical connection that enables signals from the keypad to be sent to a microprocessor in the body of the communications device for processing.

An advantage of the present invention is that the two pin connection eliminates the need to have any electrical signals from the flip cover transmitted to the body of the communications device through a hinge. Another advantage of the present invention is that the two-pin connection enables the flip cover to be completely removable and interchangeable. This allows for easy manufacture and assembly as well as the ability to connect a variety of keypads to the device.

Further features and advantages of the invention, as well as the structure and operation of various embodiments of the invention, are described in detail below with reference to the accompanying drawings.

## BRIEF DESCRIPTION OF FIGURES

The features, objects, and advantages of the present invention will become more apparent from the detailed description set forth below when taken in conjunction with the drawings in which like reference characters identify corresponding elements throughout. In the drawings, like reference numbers generally indicate identical, functionally similar, and/or structurally similar elements. The drawings in which an element first appears is indicated by the leftmost digit(s) in the corresponding reference number.

FIG. 1 is a diagram illustrating a communications device with the flip cover in the closed position;

FIG. 2 is a diagram illustrating the communications device with the flip cover in the open position; and

FIG. 3 is a circuit diagram illustrating an embodiment of the present invention.

## DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

While the present invention is described herein with reference to illustrative embodiments for particular applications, it should be understood that the invention is not limited thereto. Those skilled in the art with access to the teachings provided herein will recognize additional modifications, applications, and embodiments within the scope thereof and additional fields in which the present invention would be of significant utility.

The present invention is directed toward a system and method for connecting a keypad on a flip cover to the electronics located within the body of a communications device using a two-pin connection. The flip cover contains a first set of electrical contacts and the body of the communications device contains a second set of electrical contacts. When the flip cover is closed, the electrical contacts on the flip cover make contact with the electrical contacts on the body of the communications device to form an electrical connection that enables signals from the keypad to be sent to a microprocessor in the body of the communications device for processing.

The present invention results in a more durable communications device by eliminating the need for a flex cable to route signals from the

flip cover through a hinge to the body of the communications device. The present invention allows the flip cover to be completely removable. The flip cover can be manufactured as a separate component. The assembly of the communications device is made easy  
5 because a removable flip cover can be snapped on and off with ease. The present invention also allows the flip cover to be interchangeable. For example, different keypads localized for different countries can be implemented on the flip cover using the same communications device. Although the present invention is described in terms of a  
10 communications device comprising a combination flip telephone and personal digital assistant (PDA), the present invention is also applicable to other multi-functional communications devices that employ a flip cover having an input device implemented on the flip cover.

15 Prior to describing the invention in detail, a description of the communications device is provided. The communications device operates as a standard cellular telephone when the flip cover is in the closed position. This mode of operation is referred to as the KEYPAD mode. The communications device also operates as a PDA and  
20 telephone when the flip cover is in the open position. This mode of operation is referred to as the SMARTPHONE mode. Figure 1 illustrates a front view of communications device 100 with the flip cover in the closed position, *i.e.*, KEYPAD mode. Communications device 100 comprises a body 102 and a flip cover 112. Body 102  
25 comprises a liquid crystal display (LCD) 104, a speaker 106, a microphone 108, and an antenna 110. Flip cover 112 comprises a flip hinge 114, an exterior surface 116, and an interior surface 208 (shown in Figure 2). Flip hinge 114 is a jointed device that enables flip cover 112 to open and close by rotating flip cover 112 about flip hinge 114.  
30 Flip hinge 114 also allows flip cover 112 to be removably detached from the body 102 of communications device 100. Exterior surface 116 of flip cover 112 contains a keypad 118. Keypad 118 is a standard telephone keypad that is well known in the relevant art(s).

When flip cover 112 is closed, only a portion of LCD display 104  
35 is exposed. This portion of LCD display 104 is used to display various telephone functions, such as the date, time, redial function and a menu. Also displayed is a signal strength indicator and a digital indicator. The signal strength indicator indicates the strength of the signal being

received via antenna 110. The digital indicator indicates that the telephone is operating in digital mode. Microphone 108 and speaker 106 are used to convert variations in sound pressure, *i.e.*, voice, to variations in electrical signals or variations in electrical signals into variations in sound pressure, *i.e.*, voice, respectively. Antenna 110 is used to receive and transmit signals being sent to and from communications device 100.

Figure 2 illustrates a front view of communications device 100 with flip cover 112 in the open position, *i.e.*, SMARTPHONE mode. Body 102 of communications device 100 displays a full view of LCD 104. The top portion of LCD 104 is used to display the functions of a telephone while the bottom portion of LCD 104 displays functions related to the PDA. Such functions include all of the personal management functions found on the Palm<sup>TM</sup> III organizer, such as date book, address book, to-do list, expense management, calculator, note-taking, and games, and e-mail, web, and Alert Manager functions. Body 102 of combination flip telephone and PDA 100 also contains PDA buttons 202, a first spring loaded pogo pin 204, and a second spring loaded pogo pin 206. PDA buttons 202 allow for user input into a microprocessor (shown in FIG. 3). Notice that microphone 108 is exposed when flip cover 112 is in both the closed and open positions. This is due to the open rectangular space at the bottom of flip cover 112. Interior surface 208 of flip cover 112 contains a first contact 210 and a second contact 212.

The present invention is described in terms of the above example communications device comprising a flip telephone and PDA. Description in these terms is provided for convenience only. It is not intended that the invention be limited to application in this example communications device. In fact, after reading the following description, it will become apparent to those skilled in the relevant art(s) how to implement the invention with other communications devices having different components, functions, and levels of complexity.

Figure 3 is a circuit illustrating an embodiment of the present invention. Circuit 300 includes circuitry from flip cover 112 and circuitry from body 102 of communications device 100. The circuitry from flip cover 112 electrically connects with the circuitry from body 102 of combination flip telephone and PDA 100 when flip cover 112 is

in the closed position. First contact 210 electrically connects with first spring loaded pogo pin 204 and second contact 212 electrically connects with second spring loaded pogo pin 206 to allow for user input from keypad 118 to a microprocessor 308.

5       The circuitry found on flip cover 112 includes keypad 118 connected to first contact 210 on one side of keypad 118 and to second contact 212 on the other side of keypad 118. The circuitry for keypad 118 is a resistive ladder network. By using a resistive ladder network, the need for a plurality of signals to represent a pressed key that results  
10       from a matrix encoded keypad implementation is eliminated. The resistive ladder network only requires two signals: a voltage level representing the key pressed and ground.

      The resistive ladder network for keypad 118 includes a plurality of keys 302 connected to a plurality of resistors 304. Each key 302 is  
15       connected to one resistor 304. Each key 302 is also implemented as a switch. When a given key 302 is pressed, the resistance 304 associated with that key 302 provides a unique voltage level representing the pressed key 302 that distinguishes the pressed key 302 from any other key 302.

20       The circuitry from body 102 of communications device 100 includes first and second spring loaded pogo pins 204 and 206, an analog-to-digital converter (ADC) 306, microprocessor 308, a PNP transistor 310, and two resistors R13 and R14. The second spring loaded pogo pin 206 is connected to ground. First spring loaded pogo  
25       pin 204 is connected to ADC 306 and resistor R14. First spring loaded pogo pin 204 supplies the signal from flip cover 112 to ADC 306. ADC 306 digitizes the analog signal in order that the signal may be read by microprocessor 308. Microprocessor 308 outputs a signal called PWR  
30       KEYPAD to the base of PNP transistor 310 via resistor R13. PWR KEYPAD allows microprocessor 308 to control keypad 118 by turning the power to keypad 118 on and off. The emitter of PNP transistor 310 is connected to a voltage source  $V_s$ .  $V_s$  is typically +3.3 volts, but may vary from application to application. The collector of PNP transistor 310 is connected to the other end of resistor R14.

35       In operation, software running on microprocessor 308 enables microprocessor 308 to output a high voltage level to the base of PNP transistor 310 through resistor R13 via the PWR KEYPAD signal to turn on PNP transistor 310. When PNP transistor 310 is turned on,



current flows from the voltage source  $V_s$  through PNP transistor 310 to supply power to keypad 118. Resistor R14 is used to divide the signal being sent from flip cover 112 for input to ADC 306. When flip cover 112 is closed, ADC 306 receives as input the voltage signal from flip cover 112 routed through first and second contacts 210 and 212 to first and second spring loaded pogo pins 204 and 206. When a key 302 is pressed, the resistance associated with pressed key 302 is resistor 304. For example, the resistive value associated with key K1 is R1, key K2 is R2, key K3 is R3, and so on. The values of resistors R1 through R12 are chosen to give a unique resistance value for each key 302 on keypad 118.

When flip cover 112 is in the open position or detached from body 102 of combination flip telephone and PDA 100, ADC 306 receives as input the voltage signal from  $V_s$  minus the voltage drop from the emitter to the collector of PNP transistor 720 ( $V_{EC}$ ) and the voltage drop across resistor R14 ( $V_{R14}$ ). Microprocessor 308, via software executing on microprocessor 308, accepts as input the digitized voltage signal from ADC 306 and determines the mode of operation of communications device 100 as well as the identity of pressed key 302 when a connection between flip cover 112 and communications device 102 is made via first and second contacts 210 and 212 and first and second spring loaded pogo pins 204 and 206.

### Conclusion

While the present invention is described in terms of a communications device comprising a combination flip phone and PDA, the present invention is also applicable to other multi-functional portable devices that employ a flip cover comprising an input device. The previous description of the preferred embodiments is provided to enable any person skilled in the art to make or use the present invention. While the invention has been particularly shown and described with reference to preferred embodiments thereof, it will be understood by those skilled in the art that various changes in form and detail may be made therein without departing from the spirit and scope of the invention.

**We Claim:**

## CLAIMS

1. A system for connecting input signals from a flip portion to a  
2 body portion using a two-pin connection, comprising:
  2. a first set of electrical contacts located on said flip  
4 portion, said flip portion further comprising input means coupled  
between said first set of electrical contacts;
  - 6 3. a second set of electrical contacts located on said body  
portion, said body portion being coupled to said flip portion, wherein  
8 an electrical connection between said first and second sets of contacts  
can be made or broken based on the relative position of said flip  
10 portion to said body portion.
2. The system of claim 1, wherein said body portion further  
2 comprises a processor for determining whether said electrical  
connection between said first and second sets of contacts is made or  
4 broken by determining whether said electrical connection is based on a  
voltage measurement from said input means in said flip portion or a  
6 voltage measurement from said body portion.
3. The system of claim 2, further comprising an analog-to-  
2 digital converter for converting said voltage measurement to a digital  
signal to be read by said processor.
4. The system of claim 2, wherein said input means is a  
2 keypad.
5. The system of claim 4, wherein said keypad is a resistive  
2 ladder circuit and said voltage measurement is associated with a key  
being pressed on said keypad.
6. The system of claim 2, wherein said body portion further  
2 comprises a switching circuit for controlling said flip portion by  
turning power on and off.
7. The system of claim 6, wherein said processor controls  
2 said switching circuit.

2       8.     The system of claim 1, wherein said second set of contacts  
are spring loaded pogo pins.

2       9.     The system of claim 2, wherein said processor enables  
said system to operate in one of a first and second mode based on said  
voltage measurement.

2       10.    The system of claim 9, wherein said system operates in a  
first mode if said electrical connection between said first and second  
sets of contacts is made and said system operates in a second mode if  
4       said electrical connection between said first and second sets of contacts  
is broken.

2       11.    The system of claim 10, wherein said body portion  
operates as a telephone and personal digital assistant.

2       12.    The system of claim 11, wherein said first mode is  
KEYPAD mode.

2       13.    The system of claim 11, wherein said second mode is  
SMARTPHONE mode.

2       14.    A method for connecting input signals from a flip portion  
to a body portion using a two-pin connection, comprising the steps of:

4           supplying power to said flip portion from said body portion,  
said flip portion having a first set of contacts and input means coupled  
6       between said first set of electrical contacts and said body portion being  
coupled to said flip portion and having a second set of contacts; and  
8           determining whether an electrical connection between said first  
and second sets of contacts has been made or broken based on the  
10       relative position of said flip portion to said body portion.

2       15.    The method of claim 14, wherein said determining step  
comprises the steps of determining whether said electrical connection  
is based on one of a voltage measurement from said input means in  
4       said flip portion and a voltage measurement from said body portion  
and converting said voltage measurement to a digital signal.

- 2 16. The method of claim 15, further comprising the step of enabling said body portion to operate in one of a first and second mode based on said voltage measurement.
- 2 17. The method of claim 15, wherein said input means is a keypad.
- 2 18. The method of claim 17, wherein said keypad is a resistive ladder circuit and said voltage measurement is associated with a key being pressed on said keypad.
- 2 19. The method of claim 14, wherein said body portion further comprises a switching circuit for controlling said flip portion by turning power on and off.
- 2 20. The method of claim 19, wherein said processor controls said switching circuit.
- 2 21. The method of claim 14, wherein said second set of contacts are spring loaded pogo pins.
- 2 22. The method of claim 16, wherein said system operates in a first mode if said electrical connection between said first and second sets of contacts is made and said system operates in a second mode if said electrical connection between said first and second sets of contacts is broken.
- 2 23. The method of claim 22, wherein said body portion operates as a telephone and personal digital assistant.
- 2 24. The method of claim 23, wherein said first mode is KEYPAD mode.
- 2 25. The method of claim 23, wherein said second mode is SMARTPHONE mode.

1/3

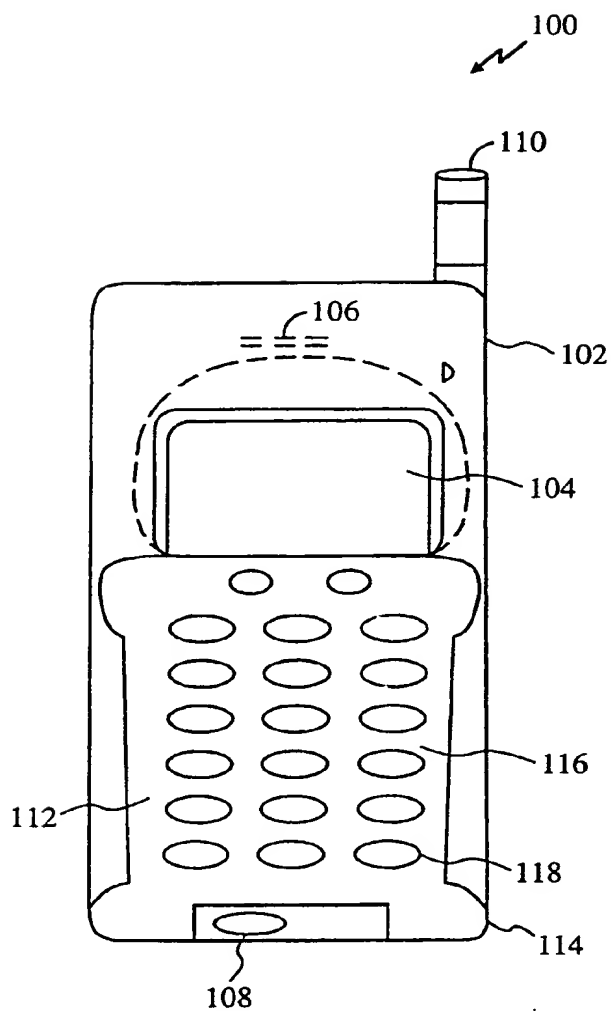


FIG. 1

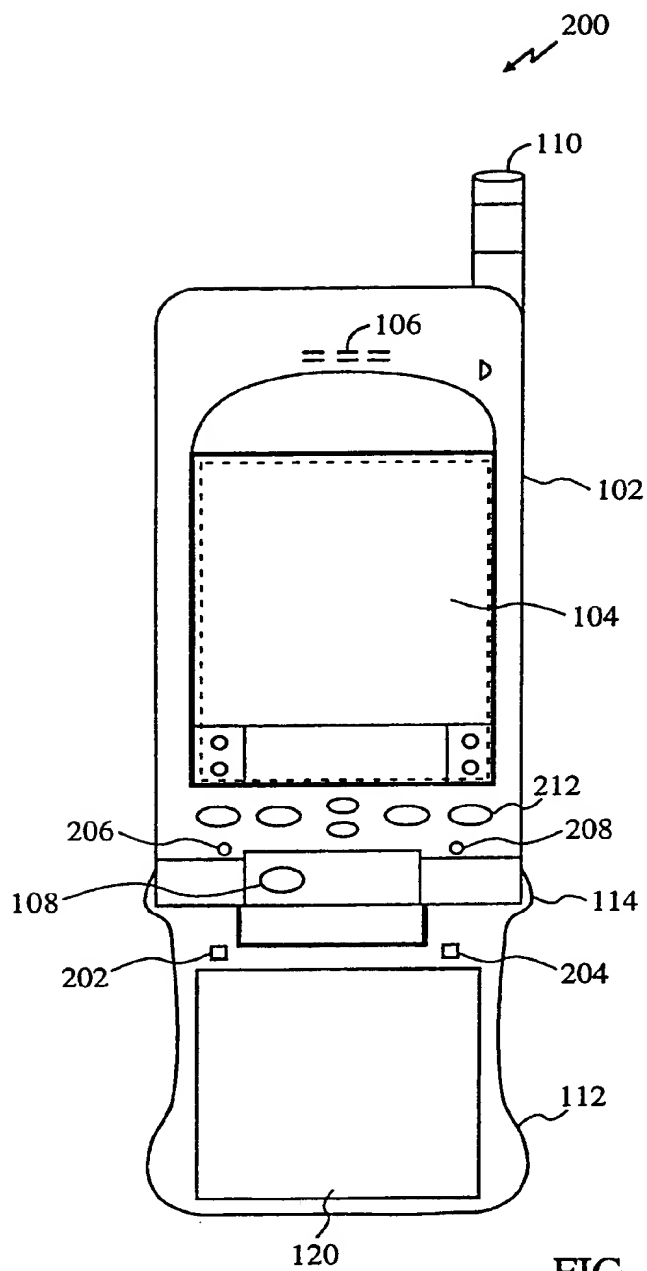
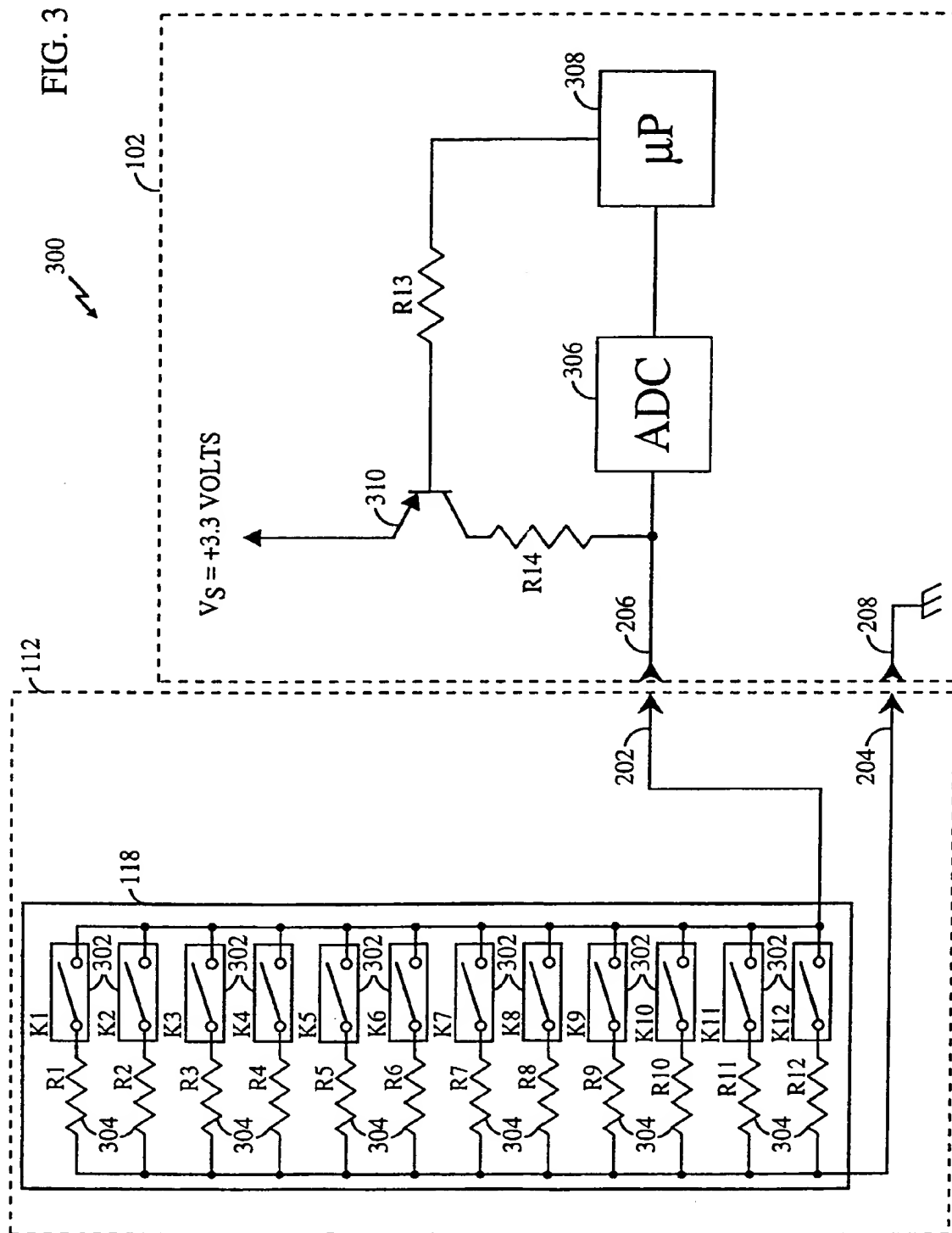


FIG. 2



# INTERNATIONAL SEARCH REPORT

International Application No  
PCT/US 00/12224

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 H01R13/703 H04M1/02

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)  
IPC 7 H01R H04M

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, INSPEC, COMPENDEX

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 26712 A (ERICSSON GE MOBILE INC) 24 July 1997 (1997-07-24) page 7, line 16 -page 8, line 4 figure 4	1-25
A	US 5 828 343 A (MA Yawei ET AL) 27 October 1998 (1998-10-27) column 4, line 50 -column 7, line 12 figure 3	1-25
A	WO 98 19434 A (ERICSSON GE MOBILE INC) 7 May 1998 (1998-05-07) page 3, line 18 -page 8, line 8 figures 3,5	1-25

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

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